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# Contact tracing and population screening for tuberculosis – who should be assessed?

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## Abstract

**Background** The aim of the study was to investigate the relative effectiveness of four strategies in detecting and preventing tuberculosis: contact tracing of smear-positive pulmonary disease, of smear-negative pulmonary disease and of non-pulmonary disease, and screening new entrants.

**Methods** An analysis of patient records and a TB database was carried out for an NHS Trust-based tuberculosis service in a socio-economically deprived area. Subjects were contacts of all patients treated for TB between 1997 and 1999. New entrants were screened in 1999. Outcomes measured were numbers of cases of active tuberculosis detected and numbers of those screened given chemoprophylaxis.

**Results** A total of 643 contacts of 227 cases of active TB were seen, and 322 new entrants to the United Kingdom. The highest proportion of contacts requiring full treatment or chemoprophylaxis were contacts of smear-positive index cases (33 out of 263 contacts; 12.5 per cent). Tracing contacts of those with smear-negative pulmonary tuberculosis (12 out of 156; 7.7 per cent) and non-pulmonary disease (14 out of 277; 6.2 per cent) was significantly more effective in identifying individuals requiring intervention (full treatment or chemoprophylaxis) than routine screening of new entrants (10 out of 322; 3.1 per cent).

**Conclusions** Screening for TB of new entrants to the United Kingdom is part of the national programme for control and prevention of TB, whereas tracing contacts of those with smear-negative and non-pulmonary disease is not. This study demonstrates that, in our population, the contact-tracing strategy is more effective than new entrant screening. It is not likely that the contacts have caught their disease from the index case, but rather that in high-incidence areas such as ours such tracing selects extended families or communities at particularly high risk.

**Keywords:** tuberculosis, contact tracing, immigrants, cost effectiveness

## Introduction

Tuberculosis (TB) is an increasing problem worldwide. In many developed countries the screening of those newly arrived from countries with a high incidence of TB and the contact tracing of known cases of TB are both part of the national strategies for TB control.

Screening of immigrants and long-stay visitors is intended to detect cases of active disease, and also those who have evidence of tuberculous infection but who have no evidence of disease activity.[1–3] This second group is of importance, as it has been estimated that an immunocompetent individual infected with tuberculosis has a lifetime risk of about 10 per cent of developing active disease.[4] Such individuals, although asymptomatic, will be offered chemoprophylaxis, which greatly reduces the risk of future active disease.[5]

The tracing of contacts of known cases of tuberculosis leads to the detection of active disease in around 1 per cent of all contacts, and up to 10 per cent of cases of TB are diagnosed at contact screening.[6–10] Smear-positive tuberculosis, in which mycobacteria can be seen on direct microscopy of a stained sputum smear, is considered infectious, and the contacts of these patients are known to be at most risk of contracting the disease. Patients referred with smear-negative but culture-positive pulmonary disease and those with non-pulmonary disease are generally considered to be non-infectious.

Current practice in the United Kingdom follows the British Thoracic Society (BTS) guidelines[11,12] and recommendations that:

(1) for pulmonary tuberculosis (smear positive or negative), close contacts (usually household contacts) should be screened for evidence of tuberculosis. Casual contacts of those with smear-negative disease are not screened, and of those with smear-positive disease need to be screened only if they are unusually susceptible (e.g. children) or if the index case is highly infectious (i.e. has infected more than 10 per cent of close contacts).[13]

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(2) Screening of contacts of non-pulmonary disease is not necessary unless the index case is likely to have been infected recently (for example, if a child). Contact screening in such cases is aimed at establishing the source from which the infection has been acquired.
(3) There should be screening of new entrants to the United Kingdom from high-risk areas of the world (TB incidence more than 40/100 000 population per year) and of all refugees, a statutory regulation.

In Tower Hamlets, East London, United Kingdom, the local population is one of the most socio-economically deprived in the country, with a large Bangladeshi population and a high annual incidence of tuberculosis (58/100 000). In our service, we have screened individuals in all four of the categories above, including the contacts of cases of non-pulmonary TB and of smear-negative pulmonary TB, to evaluate the relative effectiveness of examining these groups.

## Method

For all district residents notified as having TB over the 3 year period 1997–1999, contact tracing had been performed by specialist TB nurses. We reviewed these records and the laboratory records and hospital case notes of all contacts screened over the study period ($n = 646$, from 227 index cases). The 646 contacts were categorized according to whether the index case had smear-positive pulmonary, smear-negative pulmonary or non-pulmonary tuberculosis. Data on new entrant screening were available only for 1999; of all new entrants registered, screening was performed on 322.

In the contacts and the new entrants, two outcomes were documented: the number of cases of active tuberculosis that were detected and the number of those screened who were given chemoprophylaxis. The decision to give chemoprophylaxis was made on the basis of history, clinical examination, results of tuberculin testing and of chest X-ray in accordance with BTS guidelines.[11,12]

## Results

The Table shows, separately for contacts of each of the three categories of index cases and for new immigrants, the numbers found to have active tuberculosis and the numbers given chemoprophylaxis. The combined rate was, as expected, highest for contacts of smear-positive pulmonary cases: 33 of 263 (12.5 per cent) either had active TB or were given prophylaxis.

Contact tracing of patients with both smear-negative pulmonary TB and non-pulmonary TB also revealed persons with active TB and persons requiring prophylaxis, however; the combined prevalence was similar in each group – about 7 per cent. This rate was about twice as high as the prevalence in new immigrants from high-risk areas (in whom screening is recommended). The prevalence in contacts of cases of smear-positive pulmonary TB was only about double that in contacts of cases of smear-negative pulmonary or non-pulmonary TB.

## Discussion

Current national guidelines suggest contact tracing of cases of smear-positive pulmonary TB and household contacts of smear-negative pulmonary disease.[11,12] Contact tracing in cases of non-pulmonary disease is not recommended, but our results suggest that such an activity is at least as productive as the screening of new arrivals to the United Kingdom from high-incidence countries.

Clearly, individuals with non-pulmonary disease are not infectious and could not be the source of the infection seen in their contacts. One possibility is that active disease seen in the contacts is, if it is pulmonary, the source of the infection found in the index case. This cannot be the explanation for the contacts with non-pulmonary active disease nor for those contacts with evidence of infection but not active disease and who receive chemoprophylaxis. An alternative explanation would be that both the index case and the contact have been infected from a third individual, but in that case we would have anticipated identifying such source cases.

The final explanation, which we favour, is that by screening contacts of non-infectious TB, we are simply accessing extended

**Table** Results of contact tracing according to the category of the index case, and results of screening new entrants

| Category | Contacts of cases or new entrants | | | | |
|---|---|---|---|---|---|
| | Number of index cases | Number traced | Active TB | Given prophylaxis | Active and prophylaxis (rate) |
| Contacts of | | | | | |
| smear-positive pulmonary TB | 66 | 263 | 13 | 20 | 33 (12.5%) |
| smear-negative pulmonary TB | 78 | 156 | 3 | 9 | 12 (7.7%) |
| non-pulmonary TB | 83 | 227 | 2 | 12 | 14 (6.2%) |
| New entrants | – | 322 | 0 | 10 | 10 (3.1%)* |

*Lower than the rate in contacts of TB cases who were smear-positive pulmonary ($p < 0.001$), smear-negative pulmonary ($p = 0.03$) and non-pulmonary ($p = 0.09$).

families or communities at very high risk. Ethnically, they are likely to be high risk and even within that ethnic group they may represent a sub-group at particularly high risk. They may, for example, live in particularly high-density housing, belong to a community from which trips to the Indian subcontinent are made particularly frequently, or in which there is a relatively high proportion of older people at risk of developing post-primary TB. This may also account for the similar number of contacts of smear-negative pulmonary disease compared with smear-positive pulmonary disease needing chemoprophylaxis.

In low-incidence areas, the standard guidelines for contact tracing are likely to be appropriate. In high-incidence areas such as ours, however, contact tracing non-infectious TB should perhaps be considered differently. It should not be compared with tracing contacts of infectious TB, but its value should be measured against other activities aimed at screening high-risk populations, such as new entrants. In this sense, it is not 'contact tracing' at all, but is a 'high-risk screening' exercise. Its cost-effectiveness should be assessed with this in mind, and indeed screening of new immigrants has itself been the focus of recent critical scrutiny.[14,15]

There are significant resource implications to these activities, but at a time of heightened awareness of the increase of TB in the United Kingdom and elsewhere, and particularly in the inner cities, it is appropriate to address these issues. In high-incidence areas such as ours, the relative effectiveness of screening various populations should be considered. The principle of new entrants screening is uncritically accepted – but our results show that although it may be worth while it is less useful than other activities, at least in our area. When resources are limited, their allocation should indeed follow carefully researched national guidelines, but these may need local modification for maximal effectiveness.

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## Contributors

V.W. and J.M.G. jointly conceived the study. B.U., T.B. and V.W. collected the data, which were analysed by B.U., V.W., M.L. and J.M.G. All authors contributed to writing the paper, the penultimate and final drafts of which were prepared by B.U., V.W., M.L. and J.M.G.

## References

1 Marks GB, Bai J, Simpson SE, Sullivan EA, Stewart GJ. Incidence of tuberculosis among a cohort of tuberculin-positive refugees in Australia. *Am J Respir Crit Care Med* 2000; **162:** 1851–1854.

2 Verver S, Bwire R, Borgdorff MW. Screening for pulmonary tuberculosis among immigrants: estimated effect on severity of disease and duration of infectiousness. *Int J Tuberc Lung Dis* 2001; **5**(5): 419–425.

3 Van den Bosch CA, Roberts JA. Tuberculosis screening of new entrants; how can it be made more effective? *J Publ Hlth Med* 2000; **22**(2): 220–223.

4 Jochem K, Walley J. Determinants of the tuberculosis burden in populations. In: Porter JDH, Grange JM, eds. *Tuberculosis: an interdisciplinary perspective*. London: Imperial College Press, 1999: 33–48.

5 American Thoracic Society. Treatment of tuberculosis and tuberculosis infection in adults and children. *Am J Respir Crit Care Med* 1994; **149:** 1359–1374.

6 Hussain SF, Watura R, Casman B, Campbell IA, Evans MR. Tuberculosis contact tracing – are the British Thoracic Society guidelines still appropriate? *Thorax* 1992; **47:** 984–985.

7 Esmonde TFG, Petheram IS. Audit of TB contact tracing procedures in South Gwent. *Respir Med* 1991; **85:** 421–424.

8 Teale C, Cundall DB, Pearson SB. Time of development of TB in contacts. *Respir Med* 1991; **85:** 475–477.

9 Ormerod LP. Tuberculosis contact tracing: Blackburn 1982–90. *Respir Med* 1993; **87:** 127–131.

10 Kumar S, Innes JA, Skinner C. Yield from tuberculosis contact tracing in Birmingham. *Thorax* 1992; **47:** 875.

11 Joint Tuberculosis Committee of the British Thoracic Society. Control and prevention of tuberculosis in the United Kingdom: Code of Practice 1994. *Thorax* 1994; **49:** 1193–1200.

12 Joint Tuberculosis Committee of the British Thoracic Society. Control and prevention of tuberculosis in the United Kingdom: Code of Practice 2000. *Thorax* 2000; **55:** 887–901.

13 Veen, J. Microepidemics of tuberculosis: the stone in the pond principle. *Tubercle Lung Dis* 1992; **73:** 73–76.

14 Bothamley GH, Rowan JP, Griffiths CJ, *et al.* Screening for tuberculosis: the port of arrival scheme compared with screening in general practice and the homeless. *Thorax* 2002; **57:** 45–49.

15 Callister MEJ, Barringer J, Thanabalasingham ST, Gair R, Davidson RN. Pulmonary tuberculosis among political asylum seekers screened at Heathrow Airport. *Thorax* 2002; **57:** 152–156.

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